Economics of Columbia River Initiative

Draft Report for review by the Washington Department of Ecology and the Economics Advisory Committee.

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EXECUTIVE SUMMARY

The purpose of this study is to review the economics of water use from the Columbia River in the context of Washington State's Columbia River Initiative (CRI). The CRI is designed to address the legal, scientific, and political issues related to water use from the mainstem of the Columbia River in Washington state. The economic analysis in this report is one of several kinds of information that will be used to inform the Department of Ecology's rule-making related to the Columbia River. In addition to this review, the state has contracted with the National Academy of Sciences to consider the relationship between water use and the health of salmon populations. Consequently, this report focuses on the economic consequences of increased water diversions in the mainstem Columbia river in Washington State, including effects on agricultural production, municipal and industrial water supplies, hydropower generation, flood control, river navigation, commercial and recreational fishing, regional impacts, and passive use values. In addition to gauging these effects, the report includes a summary of issues related to the increased use of market transactions in water rights.

The analysis is focused on a series of five "Management Scenarios" developed by the Department of Ecology in consultation with water users. Roughly 4.5 million acre-feet of water is currently diverted from the Columbia river in the State, with 91% going to irrigated agriculture and 9% to municipal, industrial, domestic and other users. As shown in Table E-1, the first three Scenarios envision increasing these water rights by 1 million acre-feet (MAF) and permitting the interruptible rights (roughly 1% of the surface water rights) to be converted to non-interruptible rights. For each of these three Scenarios, the new water rights holders must meet water efficiency standards (called Best Management Practices, or BMPs) and begin metering their withdrawals. In Scenarios 2 and 3 fees are charged ($10 or $20 per acre-foot per year) for new and converted water rights, and 300 KAF of the 1 MAF is withheld until the majority of existing water users meet the BMPs. Scenario 4 envisions no overall increased in water diversions but it permits new users to obtain rights via transfer from existing users, thus mitigating for the new diversions in time and place. Scenario 5 is the "no change" or *status quo* option.

To evaluate the economic effects of second and third scenarios we developed lower level, partial allocations of the 1 MAF. These reflect the possibility that either the BMP & metering requirements or the increased fees would discourage new water applicants and keep the total new

Table E-1. Five CRI Management Scenarios

Scenario	Quantity of New Water Rights	Fees	Contingencies	Other Requirements
1	1 MAF	none	none	Meet BMPs and meter withdrawals
2	1 MAF	$10/acre-foot annually	300 KAF depends upon 80% of existing rights complying with BMPs	Meet BMPs and meter withdrawals
3	1 MAF	$20/acre-foot annual	300 KAF depends upon 80% of existing rights complying with BMPs	Meet BMPs and meter withdrawals
4	None	$30/acre-foot for transfers & conversions	New withdrawals must be fully offset by transfers, conservation or new storage.	Meet BMPs and meter withdrawals
5	Status Quo	none	Issuance of new rights follows current procedure & depends upon opinion of fishery managers.	

water rights allocation below the maximum of 1 MAF. For Scenario 2, the lower level was set at 700 KAF and for Scenario 3 the lower level allocation is set at 568 KAF. In assessing the impacts of these scenarios, we assume that the new water rights include 220 KAF for the Columbia Basin Project, 80.7 KAF goes to existing applicants for municipal and industrial water, and the remainder goes to agricultural users. We distribute the new agricultural water among river reaches and counties in a manner reflecting the locations of applications in the existing pool of water permit applications at DOE.

A major impact of the first three scenarios occurs in the irrigated agriculture sector, where new water rights allow the expansion of crop production, mainly in the Columbia Basin Project area and in Benton Country. Assuming that crop prices remain at current levels, and assessing the costs of crop production by use of crop budget studies, the gross revenue (sales value) and net revenue (sales revenue minus farm costs) of new crops was estimated for each of the Scenarios. The main results, detailed in Table E-2, are that agricultural production will

increase with the new water allocations to generate between $169 and $485million in gross revenue, which corresponds to between $18.2 and $57.8 in net revenue by farms. Most of the new crop production occurs in Benton, Douglas, Grant, and Okanogan Counties. A 73% share of the new revenue is attributed to expansion in orchards, while 10.6% is in vegetables, and 6.4 % in potatoes. Under Scenario 4, we would expect some increase in value of agricultural crops as water is transferred from lower-valued to higher-vales uses. We did not estimate the magnitude of that increase.

Table E-2. Summary of Effects on Agricultural Production and Value

Scenario	Gross Revenue	Net Revenue
1	$485 mil.	$57.8 mil.
2	$339 - 485 mil.	$37.1 mil. -$57.8 mil.
3	$169 – 485 ml.	$18.2 mil - $57.8 mil.
4	unknown but likely >0	unknown but likely >0
5	none	none

Because the Municipal and Industrial (M&I) use of water is a relatively small portion of the total withdrawals from the river, and because these uses tend to have relatively high values, we assume that these uses are higher priority than agriculture. So, we did not attempt to place an economic value on M&I, but rather estimated a nominal increase for these uses. Based upon the fact that existing M&I applications represent about 28.5% of existing M&I water rights, and that the population in the Tri-City area has grown about 32% over the past 10 years, we chose the simple assumption that M&I water use would need to increase by 30% over the period covered by the CRI process. This amounts to 80.7 KAF, which will go to high-value uses and will facilitate the expansion of towns and food processing companies in the area where agricultural production is expected to grow.

Each new diversion will decrease the stream flow in the Columbia river downstream of the diversion point. This reduced flow will cause a reduction in hydroelectric power production at 6 Federal and 5 Public Utility District dams on the mainstem of the Columbia river. Using upon a simple monthly model of irrigation water withdrawal and return flow, and assuming

hydropower production rates (megawatt-hours per unit of flow) remain as in the past, we estimate that the total loss of hydropower associated with an increased water withdrawal of 1 MAF will amount to between $9.4 million (for typical water years) and $9.7 million (for dry years). We have valued the hydropower using prices forecasted for the near future by analysts at the Bonneville Power Administration. The prices used do not take into consideration price increases that might occur in years of water shortage and high power demand.

Flood control and river navigation are important purposes served by the Federal dams in the lower Columbia and Snake rivers. The new CRI water diversions are not expected to have any effects on flood control activities, because the diversions will occur mostly during May – August, while flood control is a major factor in river operations only during the late winter and early spring high run-off period. Shallow draft river navigation (barging) occurs in the reservoir system from Bonneville dam to the Tri-cities area, and up the Snake River as far a Lewiston, Idaho. Barging is not expected to be significantly affected because reservoir levels are maintained to exceed levels necessary for lockage at dams even in dry years. Deep-draft navigation in the lower Columbia River below Bonneville dam is not expected to be affected by the new diversions, because the minimum flow needed to maintain the shipping channel depth (70 kcfs) will not be jeopardized by the small decreases in flow caused by a 1 MAF diversion.

Commercial and recreational fishing may be harmed by the increased diversions if the salmon and steelhead runs in the Columbia and Snake rivers are negatively affected. This would occur if mortality during downstream migration of juvenile fish, or upstream migration of adult fish, increases as flows decline. Lacking a scientific consensus on flow-mortality relationships, and considering that the National Research Council committee is evaluating the risks to salmon and steelhead, we did not attempt to quantify the possible economic loss. Instead, the report summarizes existing information about the economic values of fish caught in the commercial and recreational fisheries for Columbia river fish. Those values can be used at some point in the future to value the estimated change in anadromous fish runs.

When the agriculture sector expands, all related economic sectors (e.g. suppliers and food processors) are expected to expand in unison. Further, the increased incomes by wage-earners in the expanding sectors will spur increased sales of a wide variety of consumer goods, and this will cause yet additional economic expansion in the regional economy. To assess the regional economic impacts, we first estimate the “direct impacts” which encompass the increased sales of

raw and processed agricultural products. Next, we assess the full effects, considering the expanding related sectors and income-driven economic expansion of the whole economy. These economic impacts are reported in three categories: Gross Sales or Output, Employment, and Value-Added. The Output impact measures the change in sales of all products, including raw materials, wholesale products, and retail sales. Employment is calculated from that Output impact by dividing the sales in each of 62 sectors in the State economy by a standard ratio of full-time employees per $1 mil of sales. Finally, the value-added (sales minus purchases of inputs) in each sector is summed up to yield a measure that is similar to regional income. As displayed in Table E-3, the most important figures are the total employment and total value-added for each level of water diversion. To put these numbers in perspective, these impacts are relatively modest in comparison to statewide totals of $222 billion in Gross State Product in 2001 and the 3.1 million in the State workforce in 2002. Still, these impacts represent roughly a 20% expansion in the State's agricultural economy. These impact assessments are likely a bit on the high side because they do not incorporate the likely price-depressing effects of increased agricultural production.

Table E-3 Summary of Economic Impacts of Agricultural Sector Expansion ($ millions)

	Output		Employment		Value-Added	
	Direct	Total Impact	Direct	Total Impact	Direct	Total Impact
1 MAF	$1223.7	$2,826.1	12,247	29,869	$559.6	$1345.3
700 KAF	$856.7	$1,974.1	8,569	20,864	$391.7	$939.5
569 KAF	$431.0	$993.9	4,300	10,496	$196.9	$473.0

Passive use values are held by the public for all manner of economic goods, services, and conditions. Sometimes called "existence values", these represent the amount people would be willing to pay for something even if they don't plan to consume or use it. Passive use values are thought to be particularly significant for public goods that are unique and scarce. Salmon and steelhead populations in the Columbia river qualify as objects having passive use values. We reviewed economic studies that estimated values for salmon in the range of $66.28 to $268.08 per fish. The wide range of estimates reflects both variability due to the vagaries of research

methods in common use and variability associated with different descriptions of the "good" to be valued (e.g. a single endangered fish run, or a basin-wide complex of species). Like the commercial and recreational fishing values, these passive use value estimates may be applied to reductions in run size that are estimated to occur as a result of the prospective new water diversions.

Finally, we reviewed the prospects for water markets, which are an increasingly attractive alternative to regulatory or other non-market mechanisms for resolving disputes over water use and for improving the efficiency of water use. By permitting willing sellers and willing buyers to transfer water, markets will generally shift water from lower valued to higher valued uses. Three types of transactions can accomplish this result. Outright purchases of permanent water rights, temporary leases of diversionary water rights, and transfers of ownership of stored water (typically in a storage reservoir) all facilitate the increase in value of water use. While numerous water transfers of all types have occurred in Washington State, the expansion of water markets is slowed by three obstacles:

1. Third party effects of water transfer, due to shifts in return flows, have to be taken into consideration, possible involving compensation or mitigation.
2. Partly due to third party impacts, the water right that can be transferred needs to be defined in terms of consumptive use, not diversionary right, and this requires documentation and measurement that may not be immediately available.
3. There is often resistance to transfer of water from a traditional use (e.g. agriculture) to another use because of impacts on local communities and cultural attachments to traditional uses.

None of these is a fatal complication, but all three issues highlight the care required in development of a water transfer institution. Washington State has made the legal changes necessary to permit water transfers. Current law requires that such transfers be submitted to the DOE for review and approval. The ability to retain water rights while temporarily transferring water use to instream flow has also been achieved in Washington. The Washington Water Trust has purchased and leased water for enhancement of instream flows in such places as Salmon Creek, a tributary of the Okanogan river. And the DOE has a water acquisition program designed to shift water from out-of-stream use to instream flow in chosen locations. All these examples illustrate the principle that increasing transferability of water rights can, given adequate attention

to the three issues listed above, work to improve economic efficiency of water use and to improve stream flows.

CONCLUSION

The Columbia River Initiative promises to encompass a number of important developments in the economy and environment of Washington's portion of the Columbia river. While considering increased diversions of water of up to 1 million acre feet, the CRI "management scenarios" also incorporate improved water efficiency and metering requirements, and they propose levying fees for new water users of $10 to $30 per acre-foot per year, with the fee level depending upon the level of threat to salmon runs. The economic review shows that these increased diversions are (a) unlikely to have significant impacts on flood control or river navigation, (b) will have moderately large negative impacts on hydropower production, (c) will have large positive impacts on the agricultural economy and on the regional economy that encompasses agriculture, and (d) might have some negative effects on fisheries and passive use values tied to salmon and steelhead runs. To some degree, the fees proposed under the second and third management scenarios will permit the State to mitigate the effects of increased water diversion on the fish and wildlife resources. Finally, improving and facilitating the exchange of water rights among users through water markets should improve the efficiency of water use and provide opportunities to acquire water for use by fish and wildlife.